

DOCKET NO: 296975US0XPCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
TETSUZO MIKI, ET AL. : EXAMINER: CROUSE, B.A.
SERIAL NO: 10/594,273 :
FILED: JULY 24, 2007 : ART UNIT: 1786
FOR: CARBAZOLE DERIVATIVE :
CONTAINING FLUORENE GROUP
AND ORGANIC
ELECTROLUMINESCENCE
DEVICE

APPEAL BRIEF

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

SIR:

This is an appeal of Claims 1-27 in the above-identified application and the rejections set forth in the Official Action mailed November 29, 2010.

I. Real Party of Interest

The real party of interest is Hodogaya Chemical Co., Ltd.

II. Related Appeals and Interferences

Appellants, Appellants' legal representative and their assignee are not aware of any appeals or interferences which will directly affect or be directly affected by or having a bearing on the Board's decision in this appeal.

III. Status of Claims

Claims 1-27 are the only claims pending in the above-identified application.

No claims that have been presented for examination have been allowed.

No claims that have been presented for examination have been denied entry.

No claims have been withdrawn from examination.

No claims stand objected to.

No claims that have been presented for examination were canceled during prosecution.

Claims 1-27 are elected claims in this application.

Claims 1-27 stand rejected.

Claims 1-27 are appealed herein.

Claims 1-27 appear in the attached Claims Appendix.

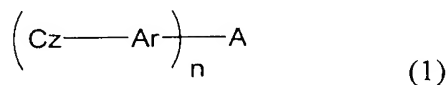
Claims 1 and 2 are the only independent claim subject to examination in this application.

IV. Status of Amendments filed under 37 C.F.R. §1.116

A Response under 37 C.F.R. §1.116 was filed February 24, 2011. This response was entered for purposes of appeal on March 16, 2011. No amendments to the claims or new evidence were submitted following the Office Action mailed November 29, 2010. Appellants now appeal the rejections set forth in the final Office Action mailed November 29, 2010.

V. Summary of the Claimed Subject Matter

The present invention is directed to a carbazole compound of formula (1):



wherein

Cz is a substituted or unsubstituted carbazole group;

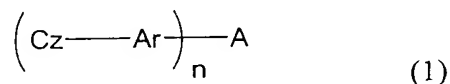
Ar is a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group;

A is an unsubstituted fluorene group; and

n is an integer of from 1 to 4.

(See, at least, original Claim 1 and the specification at page 4, line 22 to page 7, line 3, page 9, lines 6-14, and the Examples.)

The present invention is also directed to an organic electroluminescence device comprising a pair of electrodes, and at least one organic layer interposed therebetween, wherein the device contains a carbazole compound of formula (1) as a constituent material of the at least one organic layer:



wherein

Cz is a substituted or unsubstituted carbazole group;

Ar is a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is

selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group;

A is an unsubstituted fluorene group; and

n is an integer of from 1 to 4.

(See, at least, original Claim 1 and the specification at page 4, line 22 to page 7, line 3, page 9, lines 6-14, page 10, line 22 to page 13, line 19, and the Examples.)

VI. Grounds of Rejection to be Reviewed on Appeal

1. Claims 1-8, 10, 12, 17-19, 21, and 23 stand rejected under 35 U.S.C. §103(a) over Lee et al (US 2005/0074632).
2. Claims 1-9, 11, 13-20, 22, and 24-27 stand rejected under 35 U.S.C. §103(a) over Qiu et al (US 7,227,027).
3. Claims 1-9, 13, 16-20, 24, and 27 stand rejected under 35 U.S.C. §103(a) over Sato et al (JP 2002-008860).

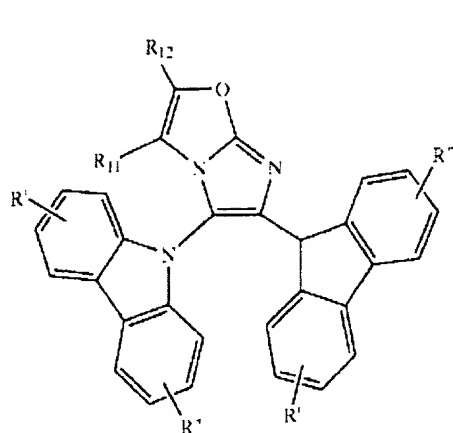
VII. Arguments

A. Claims 1-8, 10, 12, 17-19, 21, and 23 stand rejected under 35 U.S.C. §103(a) over Lee et al (US 2005/0074632). This rejection is untenable and should not be sustained.

The Examiner acknowledges that Lee differ from the claimed invention because this reference fails to specifically exemplify a compound with in the scope of the claimed invention. Indeed, Lee does not exemplify a compound where Ar is a substituted group containing the specific substituents as in the claimed invention. Specifically, Lee does not exemplify a compound where Ar is “a substituted aromatic hydrocarbon group, a substituted

aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group". Despite this acknowledgement, the Examiner alleges that the skilled artisan would have found it obvious to arrive at this distinction because the generic disclosure of the compounds within these references embrace the compounds as claimed including the substituents.

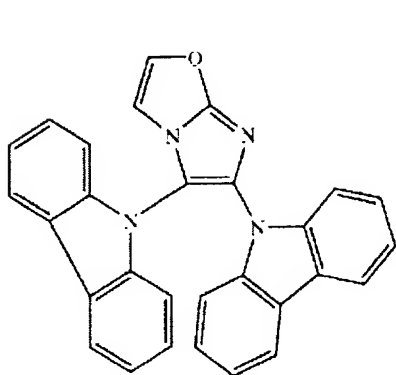
Appellants disagree with this position by the Examiner. Specifically, Lee explicitly distinguishes from the alleged substitution the Examiner alleges would be obvious based on the generic description of permissible groups for R1-R12. The Examiner points to the compound of generic formula 7 as providing the basis for this rejection. Formula 7 appears on page 3 of Lee as:



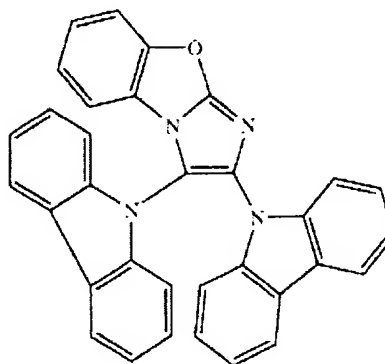
In the Office Action and again in the Advisory Action, the improperly Examiner contends that, based on paragraph [0011] the artisan would have made the substitutions to the imidazole group at R11 and R12 to arrive at the claimed invention. However, this is not correct.

The description in paragraph [0011] is related to the overly generic disclosure of the millions of possible compounds of formula 1. However, Formula 7 cited by the Examiner as the starting point for the alleged obviousness of the claimed invention specifically defines the universe of permissible substituents at R11 and R12 for the compound of Formula 7. In no way does paragraph [0033] define the permissible substituents at R11 and R12 as “preferred embodiments” as the Examiner alleges. Indeed, paragraph [0033] is quite clear and specifically limits the scope of R11 and R12 for Formula 7 as being “hydrogen or may combine together to form a substituted or unsubstituted C2-C30 saturated or unsaturated ring”.

Consistent with this restriction, in paragraph [0045] on page 31, Lee provide the following two specific compounds:



VII-118



VII-239

In view of the foregoing, Lee actually teaches away from the substitution the Examiner alleges would be obvious. The Examiner is reminded that “a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention.” *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (see MPEP §2141.02).

Thus, the reasons given above, it is respectfully requested that this rejection be REVERSED.

B. Claims 1-9, 11, 13-20, 22, and 24-27 stand rejected under 35 U.S.C. §103(a) over Qiu et al (US 7,227,027). This rejection is untenable and should not be sustained.

As was the case with Lee, the Examiner acknowledges that Qiu differs from the claimed invention because these references fail to specifically exemplify a compound within the scope of the claimed invention. Neither of these references exemplify a compound where Ar is a substituted group containing the specific substituents as in the claimed invention. Specifically, Qiu does not exemplify a compound where Ar is “a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group”. Despite this acknowledgement, the Examiner alleges that the skilled artisan would have found it obvious to arrive at this distinction because the generic disclosure of the compounds within these references embrace the compounds as claimed including the substituents. Again, Appellants disagree.

Specifically, the Examiner is reminded that when a single prior art reference which discloses a genus encompassing the claimed species or subgenus but does not expressly disclose the particular claimed species or subgenus, Office personnel should attempt to find additional prior art to show that the differences between the prior art primary reference and the claimed invention as a whole would have been obvious. MPEP §2144.08 In the case at hand, the Examiner's sole position is that the generic disclosure of Qiu embraces the claimed sub-genus of compounds and, therefore, the claimed invention is obvious. The courts have already confronted this type of rejection and rejected the same. The fact that a claimed

species or subgenus is encompassed by a prior art genus is not sufficient by itself to establish a *prima facie* case of obviousness. *In re Baird*, 16 F.3d 380, 382, 29 USPQ2d 1550, 1552 (Fed. Cir. 1994) ("The fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious."); *In re Jones*, 958 F.2d 347, 350, 21 USPQ2d 1941, 1943 (Fed. Cir. 1992) (Federal Circuit has "decline[d] to extract from *Merck [& Co. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir. 1989)] the rule that... regardless of how broad, a disclosure of a chemical genus renders obvious any species that happens to fall within it."). See also *In re Deuel*, 51 F.3d 1552, 1559, 34 USPQ2d 1210, 1215 (Fed. Cir. 1995). Thus, Appellants submit that the Examiner has not met the burden necessary to support a *prima facie* case of obviousness.

In addition to the foregoing, Appellants note that in the second paragraph of the Advisory Action, the Examiner appears to assert that Qiu discloses examples of the substituents that are mostly overlapping with the presently claimed species as the substituent to Ar. In this regard, the Examiner refers to column 6, lines 3-5 of Qiu. However, this disclosure by Qiu is not about substituents to linking groups, but about R1 to R16 (i.e., substituents to the carbazole groups). See formula III. Therefore, the Examiner's assertion is misplaced.

In lines 3-4 the last paragraph of the Advisory Action, the Examiner asserts that Sato in paragraph [0048] and Qiu in the exemplified compounds beginning in column 6 provide methyl substituents to the phenyl linking groups of the carbazole derivatives.

However, Qiu discloses examples of preferred structures, which include those having substituents on rings (e.g., compounds (3)-(6) and (12)). However, none of these compounds has a skeleton that corresponds to the presently claimed compound (in other words, these compounds do not have a fluorene group as required in the present invention). Thus, for

several specific skeleton structures, Qiu discloses structures having substituents on rings as preferred examples. Taking this into account, the skilled artisan reading the disclosure of Qiu would have been taught that the substituted structures disclosed therein are preferred. However, with regard to the skeletons for which substituted structures are not disclosed the skilled artisan would not have been taught that certain substituted embodiments of those skeletons are preferred as well. Rather, the skilled artisan would be lead to embodiments other than substituted embodiments in view of the absence of disclosed examples of substituted embodiments.

Appellants submit that even if, *arguendo*, the Examiner has sufficiently provided that a *prima facie* case of obviousness exists (a point that Appellants disagree with for the reasons above), the Examiner is reminded that "[a] *prima facie* case of obviousness ... is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties." See MPEP §2144.09 (citing *In re Paesch*, 315 F.2d 381 (C.C.P.A. 1963)). "Evidence that a compound is unexpectedly superior in one of a spectrum of common properties . . . can be enough to rebut a *prima facie* case of obviousness." No set number of examples of superiority is required. *In re Chupp*, 816 F.2d 643, 646, 2 USPQ2d 1437, 1439 (Fed. Cir. 1987)" Appellants submit that the experimental data presented in the specification clearly illustrates that substantial benefits flowing from the claimed method, which are enough to rebut even a *prima facie* case of obviousness.

In the Advisory Action, the Examiner alleges that the foregoing comparison is insufficient. It is well-established that it is necessary to compare the claimed subject matter with the closest prior art to be effective to rebut a *prima facie* case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979). Further, Applicants may compare the claimed invention with prior art that is more closely related to the invention than the prior art

relied upon by the examiner. *In re Holladay*, 584 F.2d 384, 199 USPQ 516 (CCPA 1978); *Ex parte Humber*, 217 USPQ 265 (Bd. App. 1961). Appellants submit that they have met this burden and the comparison provided is relevant.

Specifically, the closest compound in the cited art is 9,9-bis(4-carbazolylphenyl)fluorene (CDPF) appearing as formula (28) in Qiu. CDPF is identical to compound (2) (see Example 1) of the present application. In Example 4 of the present application, Appellants show that the work function of compound (3) (i.e., 9,9-bis(4-carbazolyl-3-methylphenyl)fluorene (CDMPF)) is higher than that of DCPF. Specifically, Example 4 shows the following work function for CDPF and CDMPF:

CDPF	Work function: 5.99 eV
CDMPF	Work function: 6.03 eV

In addition, Example 5 shows that the band gap value of CDMPF is greater than that of CDPF. Specifically, the band gap in Example 5 for CDPF and CDMPF were as follows.

CDPF	Gap value: 3.50 eV
CDMPF	Gap value: 3.55 eV

With respect to the foregoing data, the work function and band gap value of a host material should be greater than those of a dopant material in order for efficient energy transfer therebetween. Dopants used for fluorescence-emitting devices have high work function and band gap value. Accordingly, the compound having higher work function and band gap value than those of CDPF or CBP is highly valuable as a host material for an emitting layer of a fluorescence-emitting device since it has enhanced capability of dealing with a wider variety of dopant materials that are suitable for a fluorescence-emitting device.

Thus, to summarize the data from the examples in the present specification:

Work Function:

CDMPF(6.03) > CBP(6.00) > CDPF(5.99)

Band Gap Value:



In view of the foregoing, Appellants submit that CDMPF (representative of the presently claimed invention) is unexpectedly more suitable as a host compound for a dopant than CDPF disclosed by Qiu. Accordingly, Appellants submit that even a *prima facie* case of obviousness is rebutted and should be withdrawn.

Thus, the reasons given above, it is respectfully requested that this rejection be REVERSED.

C. Claims 1-9, 13, 16-20, 24, and 27 stand rejected under 35 U.S.C. §103(a) over Sato et al (JP 2002-008860). This rejection is untenable and should not be sustained.

As was the case with Lee, the Examiner acknowledges Sato differs from the claimed invention because these references fail to specifically exemplify a compound within the scope of the claimed invention. Neither of these references exemplify a compound where Ar is a substituted group containing the specific substituents as in the claimed invention. Specifically, Sato does not exemplify a compound where Ar is “a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group”. Despite this acknowledgement, the Examiner alleges that the skilled artisan would have found it obvious to arrive at this distinction because the generic disclosure of the compounds within these references embrace the compounds as claimed including the substituents. Again, Applicants disagree.

Specifically, the Examiner is reminded that when a single prior art reference which discloses a genus encompassing the claimed species or subgenus but does not expressly disclose the particular claimed species or subgenus, Office personnel should attempt to find additional prior art to show that the differences between the prior art primary reference and the claimed invention as a whole would have been obvious. MPEP §2144.08 In the case at hand, the Examiner sole position is that the generic disclosure of Sato embrace the claimed sub-genus of compounds and, therefore, the claimed invention is obvious. The courts have already confronted this type of rejection and rejected the same. The fact that a claimed species or subgenus is encompassed by a prior art genus is not sufficient by itself to establish a *prima facie* case of obviousness. *In re Baird*, 16 F.3d 380, 382, 29 USPQ2d 1550, 1552 (Fed. Cir. 1994) ("The fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious."); *In re Jones*, 958 F.2d 347, 350, 21 USPQ2d 1941, 1943 (Fed. Cir. 1992) (Federal Circuit has "decline[d] to extract from *Merck [& Co. v. Biocraft Laboratories Inc.*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir. 1989)] the rule that... regardless of how broad, a disclosure of a chemical genus renders obvious any species that happens to fall within it."). See also *In re Deuel*, 51 F.3d 1552, 1559, 34 USPQ2d 1210, 1215 (Fed. Cir. 1995). Thus, Applicants submit that the Examiner has not met the burden necessary to support a *prima facie* case of obviousness.

In lines 3-4 the last paragraph of the Advisory Action, the Examiner asserts that Sato in paragraph [0048] and Qiu in the exemplified compounds beginning in column 6 provide methyl substituents to the phenyl linking groups of the carbazole derivatives.

However, as was the case with Qiu above, Sato discloses examples of preferred structures, which include those having substituents on rings. However, none of these compounds has a skeleton that corresponds to the presently claimed compound (in other

words, these compounds do not have a fluorene group as required in the present invention). Thus, the skilled artisan reading the disclosure of Sato would have been taught that the substituted structures disclosed therein are preferred. However, with regard to the skeletons for which substituted structures are not disclosed the skilled artisan would not have been taught that certain substituted embodiments of those skeletons are preferred as well. Rather, the skilled artisan would be lead to embodiments other than substituted embodiments in view of the absence of disclosed examples of substituted embodiments.

Applicants submit that even if, *arguendo*, the Examiner has sufficiently provided that a *prima facie* case of obviousness exists (a point that Applicants disagree with for the reasons above), the Examiner is reminded that "[a] *prima facie* case of obviousness ... is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties." See MPEP §2144.09 (citing *In re Paesch*, 315 F.2d 381 (C.C.P.A. 1963)). "Evidence that a compound is unexpectedly superior in one of a spectrum of common properties . . . can be enough to rebut a *prima facie* case of obviousness." No set number of examples of superiority is required. *In re Chupp*, 816 F.2d 643, 646, 2 USPQ2d 1437, 1439 (Fed. Cir. 1987)" Applicants submit that the experimental data presented in the specification clearly illustrates that substantial benefits flowing from the claimed method, which are enough to rebut even a *prima facie* case of obviousness.

In the Advisory Action, the Examiner alleges that the foregoing comparison is insufficient. It is well-established that it is necessary to compare the claimed subject matter with the closest prior art to be effective to rebut a *prima facie* case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979). Further, Applicants may compare the claimed invention with prior art that is more closely related to the invention than the prior art relied upon by the examiner. *In re Holladay*, 584 F.2d 384, 199 USPQ 516 (CCPA 1978); *Ex*

parte Humber, 217 USPQ 265 (Bd. App. 1961). Appellants submit that they have met this burden and the comparison provided is relevant.

Specifically, the closest compound in the cited art is 9,9-bis(4-carbazolylphenyl)fluorene (CDPF) appearing as compound (H-11) of Sato. CDPF is identical to compound (2) (see Example 1) of the present application. In Example 4 of the present application, Applicants show that the work function of compound (3) (i.e., 9,9-bis(4-carbazolyl-3-methylphenyl)fluorene (CDMPF)) is higher than that of DCPF. Specifically, Example 4 shows the following work function for CDPF and CDMPF:

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In addition, Example 5 shows that the band gap value of CDMPF is greater than that of CDPF. Specifically, the band gap in Example 5 for CDPF and CDMPF were as follows.

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With respect to the foregoing data, the work function and band gap value of a host material should be greater than those of a dopant material in order for efficient energy transfer therebetween. Dopants used for fluorescence-emitting devices have high work function and band gap value. Accordingly, the compound having higher work function and band gap value than those of CDPF or CBP is highly valuable as a host material for an emitting layer of a fluorescence-emitting device since it has enhanced capability of dealing with a wider variety of dopant materials that are suitable for a fluorescence-emitting device.

Thus, to summarize the data from the examples in the present specification:

Work Function:

$$\text{CDMPF}(6.03) > \text{CBP}(6.00) > \text{CDPF}(5.99)$$

Band Gap Value:

$$\text{CDMPF}(3.55) > \text{CDPF}(3.50) > \text{CBP}(3.44)$$

In view of the foregoing, Applicants submit that CDMPF (representative of the presently claimed invention) is unexpectedly more suitable as a host compound for a dopant than CDPF disclosed by Sato. Accordingly, Applicants submit that even a *prima facie* case of obviousness is rebutted and should be withdrawn.

Thus, the reasons given above, it is respectfully requested that this rejection be REVERSED.

VIII. CONCLUSION

For the above reasons, Claims 1-27 are patentable over the art of record. Therefore, the Examiner's rejection should be REVERSED.

Respectfully submitted,

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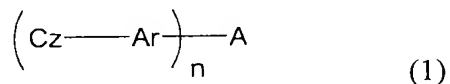
Vincent K. Shier, Ph.D.
Registration No. 50,552

Attachments: Claims Appendix:
Evidence Appendix
Related Proceedings Appendix

CLAIMS APPENDIX

Claims involved in this Appeal of U.S. Application Serial No. 10/594,273.

1. A carbazole compound of formula (1):



wherein

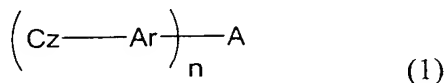
Cz is a substituted or unsubstituted carbazole group;

Ar is a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group;

A is an unsubstituted fluorene group; and

n is an integer of from 1 to 4.

2. An organic electroluminescence device comprising a pair of electrodes, and at least one organic layer interposed therebetween, wherein the device contains a carbazole compound of formula (1) as a constituent material of the at least one organic layer:



wherein

Cz is a substituted or unsubstituted carbazole group;

Ar is a substituted aromatic hydrocarbon group, a substituted aromatic heterocyclic group, or a substituted condensation polycyclic aromatic group, wherein the substituent is selected from the group consisting of a fluorine atom, a chlorine atom, a cyano group, a nitro

group, an alkyl group, an alkoxy group, a trifluoromethyl group, a phenyl group, a tolyl group, a naphthyl group, and an aralkyl group;

A is an unsubstituted fluorene group; and

n is an integer of from 1 to 4.

3. The organic electroluminescence device as claimed in claim 2, containing the carbazole compound of formula (1) in an emission layer.

4. The organic electroluminescence device as claimed in claim 2, wherein emission from the device is mainly phosphorescence emission.

5. The organic electroluminescence device as claimed in claim 3, wherein emission from the device is mainly phosphorescence emission.

6. The organic electroluminescence device as claimed in claim 2, wherein at least one Cz-Ar substituent in the carbazole compound of formula (1) is attached at the 9-position of the fluorene group A.

7. The organic electroluminescence device as claimed in claim 2, wherein Cz is a substituted carbazole group.

8. The organic electroluminescence device as claimed in claim 2, wherein Cz is a unsubstituted carbazole group.

9. The organic electroluminescence device as claimed in claim 2, wherein Ar is a substituted aromatic hydrocarbon group.

10. The organic electroluminescence device as claimed in claim 2, wherein Ar is a substituted aromatic heterocyclic group.

11. The organic electroluminescence device as claimed in claim 2, wherein Ar is a substituted condensation polycyclic aromatic group.

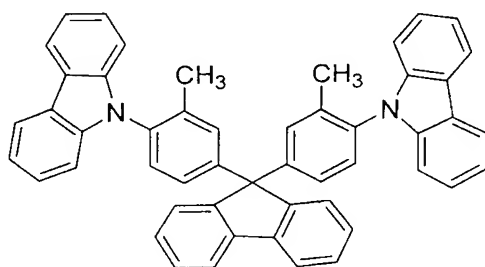
12. The organic electroluminescence device as claimed in claim 2, wherein n is 1.

13. The organic electroluminescence device as claimed in claim 2, wherein n is 2.

14. The organic electroluminescence device as claimed in claim 2, wherein n is 3.

15. The organic electroluminescence device as claimed in claim 2, wherein n is 4.

16. The organic electroluminescence device as claimed in claim 2, wherein the carbazole compound of formula (1) is a compound of formula (3):



(3).

17. The carbazole compound of formula (1) as claimed in claim 1, wherein at least one Cz-Ar substituent in the carbazole compound of formula (1) is attached at the 9-position of the fluorene group A.

18. The carbazole compound of formula (1) as claimed in claim 1, wherein Cz is a substituted carbazole group.

19. The carbazole compound of formula (1) as claimed in claim 1, wherein Cz is a unsubstituted carbazole group.

20. The carbazole compound of formula (1) as claimed in claim 1, wherein Ar is a substituted aromatic hydrocarbon group.

21. The carbazole compound of formula (1) as claimed in claim 1, wherein Ar is a substituted aromatic heterocyclic group.

22. The carbazole compound of formula (1) as claimed in claim 1, wherein Ar is a substituted condensation polycyclic aromatic group.

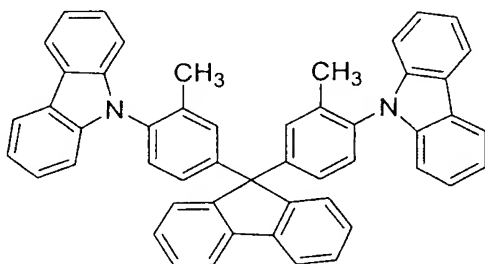
23. The carbazole compound of formula (1) as claimed in claim 1, wherein n is 1.

24. The carbazole compound of formula (1) as claimed in claim 1, wherein n is 2.

25. The carbazole compound of formula (1) as claimed in claim 1, wherein n is 3.

26. The carbazole compound of formula (1) as claimed in claim 1, wherein n is 4.

27. The carbazole compound of formula (1) as claimed in claim 1, wherein the carbazole compound of formula (1) is a compound of formula (3):



(3).

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None